REMARKS

Claims 1 - 33 are pending. Claims 1, 3 - 33 have been amended. No new matter has been introduced. Reexamination and reconsideration of the application are respectfully requested.

As requested in the accompanying Request for Change of Address, please direct future correspondence regarding this application as follows: Roger R. Wise, Pillsbury Winthrop LLP, 725 S. Figueroa, Suite 2800, Los Angeles, CA 90017.

In the July 2, 2003 Office Action, the Examiner objected to the drawings as failing to comply with 37 C.F.R. 1.84(p)(5). The Examiner objected to the specification because the title of the invention is not descriptive and a figure is mislabeled. The Examiner rejected claims 1 - 8 and 11 - 19 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,072,772 to Charny et al. (the Charny reference). The Examiner rejected claims 9, 10, 20, and 23 - 33 under 35 U.S.C. § 103(a) as being unpatentable over the Charny reference in view of U.S. Patent No. 6,484,209 to Momirov (the Momirov reference). These rejections are respectfully traversed.

Fig. 8 has been amended to delete reference numeral 200. A red-lined copy of the amended Fig. 8 has been attached hereto. The specification has been amended to include descriptions of reference numerals 5a - 5z of figure 2 and reference numerals 10 and 12 of figure 3. Applicants respectfully submit that the drawings comply with 37 CFR 1.84(p)(5).

The title of the invention has been amended to be more descriptive. In addition, the correct figure for reference numeral 51 has been identified.

The present invention is directed to a data switch for transmitting data packets

between MAC devices MAC_0 through MAC_{n+2}. Each MAC device is associated with an input port and an output port. Each MAC device receives data packets having a destination associated with one of the other MAC devices. The MAC devices forward data frames to a corresponding input port. The input port then transmits the data frames through a crossbar to an output port corresponding with the MAC device associated with the destination of the data frame. Each input port maintains at least one virtual output queue in a RAM buffer for each output port. The size of the RAM buffer may be selected based upon the input media speed relative to the aggregate data rate from an input port to the crossbar. The frame selector selects frames to be forwarded across the crossbar to the output ports. The input ports communicate with sections of the crossbar to manage output congestion at each crossbar section. Output congestion can occur if a data cell cannot be forwarded to an output port because of unavailability of locations in output queues of a crossbar section. A crossbar includes a plurality of crossbar sections, each section being coupled to receive data from any one of the input ports and transmit data to any one of the output ports. The aggregate data rate on links between an input port and a section of the crossbar is twice the rate of data being received at the input port. Input ports have a communication link to each of the crossbar sections. Each of the output ports has a communication link to each of the crossbar sections of the crossbar. Each of the sections of the crossbar maintain one output queue per output port. Each input port transmits data cells to the sections of the crossbar independently to enable efficient operation and modular implementation.

Independent claim 1, as amended, recites:

> A switching fabric for transmitting data frames to destinations, each

data frame having a destination, the switching fabric comprising:

a plurality of input ports for partitioning portions of received data frames to provide data cells; and

a plurality of crossbar sections, each of the *crossbar sections being coupled to each of the input ports for receiving the data cells at cell transfer intervals on a data link coupled between each of the input ports and each of the crossbar sections, each of the crossbar sections being coupled to transmit the data cells to any one of a plurality of output ports*,

wherein each of the input ports includes logic for scheduling the transmission of each data cell of each said data frame received at each of the input ports during a cell transfer interval for each data link coupled between each of the input ports and each of the crossbar sections based upon an ability of each of the crossbar sections to receive the data cells of the data frames with a destination associated with each of the output ports.

The Charny reference is directed to a method or an arbitration scheme for providing bandwidth and delay guarantees in a crossbar switch with speedup. The underlying architecture of the input-buffered crossbar switch is a single crossbar with n x m queues, where n is the number of input channels 12 and m is the number of output channels 14. Each input channel has one or more input ports 16, each of which corresponds to a physical input link 18. Similarly, the output channels have one or more output ports 20, each of which corresponds to a physical output link 22. The input channels 12 are connected to the output channels 14 by way of a crossbar unit 24.

Each input channel 12 has m per-output-channel queues 26, one for each output channel j 14. The input channel maintains a single flow-level scheduler, which needs to schedule only a single flow per cell time. Also located at each input channel 12 is a rate controller 30 (or scheduler) which schedules or selects for processing one or more of the virtual output queues at every channel cell time. *(Col. 5, line 40 - col. 7, line 67).*

Indices or pointers to the queues Q(i,j) chosen at each cell time are given to an arbiter 32, which is located in the crossbar unit. The arbiter is responsible for determining which of the input channels should be able to transmit a cell to particular output channels. The arbiter maintains n x m queues 34, denoted by A(i, j) with each arbiter queue corresponding to a different one of Q(i,j). *(Col. 7, lines 1 - 34).*

The Charny reference does not disclose, teach, or suggest the switching fabric of independent claim 1, as amended. Unlike the switching fabric of independent claim 1, as amended, the Charny reference does not show a switching fabric for transmitting data frames to destinations, each data frame having a destination, the switching fabric including: a plurality of input ports for partitioning portions of received data frames to provide data cells; and *a plurality of crossbar sections, each* of the *crossbar sections being coupled to each of the input ports for receiving the data cells at cell transfer intervals on a data link coupled between each of the input ports and each of the crossbar sections, each of the crossbar sections being coupled to transmit the data cells to any one of a plurality of output ports*, wherein each of the input ports includes logic for scheduling the transmission of each data cell of each said data frame received at each of the input ports during a cell transfer interval for each data link coupled between each of the input ports and each of the crossbar sections based upon an

ability of each of the crossbar sections to receive the data cells of the data frames with a destination associated with each of the output ports.

Instead, the Charny reference discloses a single crossbar switch coupled to each input channel, not input port, and also coupled to each output channel, not output port. This is not the same as a switching fabric for transmitting data frames to destinations, the switching fabric including: a plurality of input ports; and *a plurality of crossbar sections, each of the crossbar sections being coupled to each of the input ports for receiving the data cells at cell transfer intervals on a data link coupled between each of the input ports and each of the crossbar sections, each of the crossbar sections being coupled to transmit the data cells to any one of a plurality of output ports*, because the Charny reference only discloses a single crossbar. Further, each input channel of the Charny reference is coupled to the crossbar and this is not the same as each *crossbar section* being coupled to *each input port*. In addition, because the Charny reference only discloses a single crossbar and not a plurality of crossbar sections, it is not possible for the Charny reference to show each of the crossbar sections to be coupled to transmit data cells to any of a plurality of output ports. Accordingly, applicants respectfully submit that independent claim 1, as amended, distinguishes over the Charny reference.

Independent claim 1, as amended, further distinguishes over the Charny reference. Unlike the switching fabric of independent claim 1, as amended, the Charny reference does not show a switching fabric for transmitting data frames to destinations, each data frame having a destination, the switching fabric including: a plurality of input ports for partitioning portions of received data frames to provide data cells; and a

plurality of crossbar sections, each of the crossbar sections being coupled to each of the input ports for receiving the data cells at cell transfer intervals on a data link coupled between each of the input ports and each of the crossbar sections, each of the crossbar sections being coupled to transmit the data cells to any one of a plurality of output ports, *wherein each of the input ports includes logic for scheduling the transmission of each data cell of each said data frame received at each of the input ports during a cell transfer interval for each data link coupled between each of the input ports and each of the crossbar sections based upon an ability of each of the crossbar sections to receive the data cells of the data frames with a destination associated with each of the output ports.*

Instead, the Charny reference discloses that each input channel maintains a single flow-level scheduler which needs to schedule only a single flow per cell time. *(Col. 6, lines 54 - 60).* This is not the same as a switching fabric including a plurality of input ports and a plurality of crossbar sections wherein each of the input ports includes logic for scheduling the transmission of each data cell of each said data frame received at each of the input ports because each *input channel* of the Charny reference, not *input port*, has a scheduler. Accordingly, applicants respectfully submit that independent claim 1, as amended, further distinguishes over the Charny reference.

The Momirov reference does not make up for the deficiencies of the Charny reference. The Momirov reference is directed to a method and apparatus for efficiently switching data through a switch fabric. The switching device 400 is an output buffered shared memory switch. Switching device 400 includes a plurality of I/O interfaces 410 coupled in communication with a switch core. The switch core comprises a switch

fabric 450 and a fabric interface 475. Also coupled to the switch core via interface 485 is a CPU 490 which may facilitate management of forwarding and filtering databases of the I/O interfaces 410. *(Col. 6, lines 19 - 38).*

Inbound packet data is provided by the I/O interface 410 to the fabric interface 475 which steers the data through the switch fabric 450. When the packet exits the switch fabric 450, it passes again through the fabric interface 475 and ultimately to one or more interfaces 410 from which the packet data is to be transmitted. The I/O interfaces are coupled to the switch core through one or more bus interfaces 435. The bus interfaces 435 move packet data between the switch core and the I/O interfaces 410. The bus interface may comprise a plurality of point-to-point buses coupling each I/O interface to the fabric interface 475. The fabric interface 475 muxes the tap buses 435 into a bus 476 coupled to the switch fabric. *(Col. 6, lines 19 - 65).*

Each I/O interface 410 may include one or more Port Interface Devices (PIDs), such as a quad-port interface (QUID) 420. The I/O interfaces 410 may each additionally include one or more Media Access Controllers (MACs) 425, Address Resolution Units (ARUs) 430, and memories 415. *(Col. 7, lines 12 - 37).*

The Momirov reference does not disclose, teach, or suggest the method of independent claim 1, as amended. Unlike the switching fabric of independent claim 1, as amended, the Momirov reference does not disclose a switching fabric for transmitting data frames to destinations, each data frame having a destination, the switching fabric including: a plurality of input ports for partitioning portions of received data frames to provide data cells; and *a plurality of crossbar sections, each* of the *crossbar sections being coupled to each of the input ports for receiving the data cells at*

cell transfer intervals on a data link coupled between each of the input ports and each of the crossbar sections, each of the crossbar sections being coupled to transmit the data cells to any one of a plurality of output ports, wherein each of the input ports includes logic for scheduling the transmission of each data cell of each said data frame received at each of the input ports.

Instead, the Momirov reference discloses a switching device including a plurality of I/O interfaces coupled in communication with a single switch core, wherein the switch core comprises a switch fabric and a fabric interface. Also, the Momirov reference teaches the I/O interfaces coupled to MAC devices. This is not the same as a switching fabric for transmitting data frames to destinations, the switching fabric including: a plurality of input ports; and *a plurality of crossbar sections, each of the crossbar sections being coupled to each of the input ports for receiving the data cells at cell transfer intervals* because the Momirov reference is only found to disclose a single switch core and not a plurality of crossbar sections. Accordingly, applicants respectfully submit that independent claim 1, as amended, distinguishes over the Momirov reference, alone or in combination with the Charny reference.

Independent claims 12 and 23, both as amended, recite limitations similar to independent claim 1, as amended. Accordingly, applicants respectfully submit that independent claims 12 and 23, both as amended, distinguish over the Charny and Momirov references, alone or in combination.

Claims 2 - 11, 13 - 22, and 24 - 33, depend directly or indirectly, from independent claims 1, 12, and 23, respectfully. Accordingly, applicants respectfully submit that claims 2 - 11, 13 - 22, and 24 - 33 distinguish over the Charny and Momirov

references, alone or in combination, for the reasons set forth above with respect to independent claim 1.

Applicants believe that the claims are in condition for allowance, and a favorable action is respectfully requested. If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call either of the undersigned attorneys at the Los Angeles telephone number (213) 488-7100 to discuss the steps necessary for placing the application in condition for allowance should the Examiner believe that such a telephone conference would advance prosecution of the application.

Respectfully submitted,

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